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GEOPHYSICAL ABSTRACTS

NO. XVII

BY

FREDERICK W. LEE

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GEOPHYSICAL ABSTRACTS[1]

No. 17.

Compiled by Frederick W. Lee[2]

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1. GRAVITATIONAL METHODS.

INTERPRETATION OF GRAVITATIONAL ANOMALIES

By H. Shaw

The American Institute of Mining and Metallurgical Engineers,
Technical Publication No. 338, 1930, 33 pp.

This article is the continuation of the author's previous paper (Technical Publication No. 178; see Geophysical Abstracts No. 5) in which he analyzed the gravitational effects arising from certain subterranean anomalies of simple form, and extending to infinity in three directions.

In this article, which may serve as a preliminary work to further analyses of more complex structures, certain factors are examined which characterize (1) the simple infinite vertical block and (2) an infinite block which is inclined to the vertical—formations which are of considerable practical interest, as they are typical of important geological structures.

As in the earlier work, consideration of these factors is limited almost entirely to an analysis of the features and characteristics of the gradient and differential curvature.

Part I. Infinite vertical block.—The case of a vertical block rising from an infinite depth and also extending to infinity in the two directions +y and -y is considered:

(a) Gradient characteristics: Variation of maximum gradient with depth; position of the maximum gradient; variation of gradient with distance from midpoint; gradient value at definite distance from center line; inclination of the gradient curve at the origin; gradient interpretation.

(b) Characteristics of differential curvature: Variation of maximum curvature with depth; position of maximum curvature; variation of curvature with distance from center line; positions at which curvature attains definite values; curvature interpretation.

(c) Comparison of gradient and curvature effects: Intersection of gradient and curvature values; combined gradient and curvature interpretation; geometrical construction; comparison of horizontal and vertical infinite blocks.

Part II. Infinite inclined block.—The case of an inclined dike or lode is examined, and the characteristics of the gravitational effects resulting from such an anomaly are compared with those of the vertical block.

(a) Gradient characteristics: Value of maximum gradient; position of maximum gradient; gradient over midpoint of block; position of zero gradient; comparison of the first and second maximum gradients; gradient interpretation.

(b) Characteristic of differential curvature: Determination of curvature value; variation of maximum curvature with depth; curvature over midpoint of block; differential curvature interpretation; comparison of gradient and curvature effects.

(c) Combined gradient and curvature interpolation.

The article is illustrated by 30 diagrams.—W. Ayvazoglou.

EINE NEUE KONSTRUKTION DER EÖTVÖSSCHEN DREHWAGE

(A NEW CONSTRUCTION OF EÖTVÖS' TORSION BALANCE)

By Stefan Rybar

Mathematisch-Naturwissenschaftlicher Anzeiger, Budapest,
No. 46, 1926, pp. 698-723.

In the first part of the article the author examines the fundamental principles, established in 1924, by the application of which a considerable reduction in the size of the Eötvös torsion balance could be obtained without lessening the sensitivity of the instrument. In the second part Rybar discusses the investigations concerning the elimination of the disturbing influences appearing in the torsion balance, and in the last part a description of the mechanical construction of the torsion balance is given.—Abstract translated from the Physikalische Berichte, vol. 11, No. 7, 1930.

THE BIFILAR PENDULUM

By Paul E. Klopsteg

The Review of Scientific Instruments, vol. 1, No. 1, 1930, pp. 3-8.

The author states that in reviewing the literature on the bifilar pendulum he was convinced that the bifilar pendulum was worthy of study to determine its merits as educational apparatus.

In connection with a figure Klopsteg discusses briefly the ideal bifilar pendulum and its construction. Two figures show some details of the construction. Special arrangements for adjusting the lengths of the filaments are described.—W. Ayvazoglou.

GRAVITATIONAL METHOD OF PROSPECTING (IN SERBIAN)

By D. V. Frost

Rudarski i Topionicki Vesnik (Bulletin of Mining and Metallurgical Industry),
Belgrade, vol. 2, No. 4, 1930, pp. 172-178.

This is a continuation of a brief mathematical theory of the gravitational method and its application in practice. (See Geophysical Abstracts No. 12, p. 3).—V. Gorsky.

PROBLEMS OF GRAVIMETRICAL INVESTIGATIONS IN THE REGION OF NIJNE-TAGILSK IN THE URALS (IN RUSSIAN)

By A. N. Zavaritsky

Gorny Journal (Mining Journal), Moscow, 1924, Nos. 9-10.

Platinum deposits of the Urals are closely connected with the dunite massives surrounded by a strip of pyrexonite situated in the zone of gabbro. From the theoretical and practical viewpoint the question of the form of the gabbro-peridotite massif is important—that is, whether it is of batholith or laccolith form. In the first case almost improbable figures of the increase of the content of platinum with the depth of the massif can be expected. In the second case, concentration of platinum at the bottom of the laccolith—similar, for example, to the pyrrhotite deposits in Sudbury—must be expected if consideration is given to the hypothesis of settling of platinum owing to its higher specific gravity.

The author gives data of measurements of the force of gravity carried out by means of Sterneck's pendulum in 1900 and 1903 by the Kazan observatory. The high values of the positive anomalies determined in the region of the gabbro-peridotite massif speak in favor of laccolith. But these measurements can not be considered sufficient for any conclusions, owing to their small number and distribution over a large area; thus the author proposes to carry out detailed and accurate measurements which will be important for making clear the structure of the area and will put on a practical basis the question of prospecting and mining of platinum deposits.--V. Gorsky.

PRIMARY PLATINUM DEPOSITS OF THE URALS (IN RUSSIAN)

By A. N. Zavaritsky

Comité Géologique de l'U.S.S.R. Máteriaux pour la géologie générale et appliquée,
No. 3, Leningrad, 1928, pp. 1-56.

The author describes the Ural primary deposits of platinum and gives an interesting theory of their origin. The intensive study of the platinum-bearing region by Russian scientists during the last years was accompanied also by gravimetric measurements in connection with the problem proposed by the author in one of his previous articles (see the article preceding). Zavaritsky communicates the results of the work carried out in 1924 by the Astronomic-Geodetical Institute (determination of the force of gravity according to observations on pendulum oscillations in Stuckratt's apparatus) and by the Institute of Practical Geophysics (determination of gradient of the force of gravity by means of Eötvös' torsion balance).

The work of studying the structure of the eruptive complex carried out with the Eötvös torsion balance, although more complicated and accurate than that with the pendulum, did not add any essential results. The pendulum gives directly the necessary indications on the form of the deposit and the size of the gabbro-peridotite massif. Conclusions from the measurements were drawn by A.

Gijitsky (Bulletin of the Astronomical Institute No. 9, 1925). Along the border between the sedimentary rocks of the western slope of the Urals and the eruptive complex a sharp increase of positive anomalies of force of gravity is observed. This increase can best be explained by the fact that there exists, to the east of the summit, a curve of force of gravity anomaly of more compact masses, the specific gravity of which differs from that of the rock situated to the west at from 0.25 to 0.30. These heavy masses extend over more than 10 kilometers; on the western side they are limited by abruptly sloping ground. By assuming a greater difference in densities of the two series of rocks the course of the curve of the anomaly can not be explained satisfactorily.

From the last condition a conclusion can be drawn that the gravimetric investigation indicates the presence of heavy gabbro masses or greenstone masses. The specific gravity of dunite is equal to 3.25; that is, is higher than the specific gravity of sedimentary rocks at about 0.6. According to the conclusions drawn by Gijitsky based on gravimetric observations, the extension of dunite to a considerable depth (10 km.) seems improbable. The difference in densities (0.25 - 0.30) required for the explanations of the anomaly is two times smaller than it would be in case of the existence of dunite; thus it must be supposed that the size of the latter is limited. Gravimetrical investigations do not solve the question of the depth of dunite, but on the other hand they do not contradict the assumption of laccolite deposit of gabbroperidotite massif with gabbro-batholithic root deposits. Therefore the hypothesis of the existence of a dunite massif preserving its structure at a great depth seems improbable.--V. Gorsky.

NOMOGRAPHS FOR CALCULATING THE SECOND DERIVATIVES OF THE FORCE OF GRAVITY POTENTIAL OBTAINED BY OBSERVATIONS MADE WITH A TORSION BALANCE AT 5 AZIMUTHS

By A. Stepanoff

Department of Commerce, U. S. Bureau of Mines,
Information Circular 6306, 1930, 7 pp.

On the basis of an example the author describes the process of construction of nomographs by which the second derivatives of the force of gravity potential obtained by observations made with a torsion balance at 5 azimuths may be found directly.--W. Ayvazoglou.

2. MAGNETIC METHODS

MAGNETISCHE MESSUNGEN IN BERGGIESSHÜBEL

(MAGNETIC MEASUREMENTS IN BERGGIESSHÜBEL)

By H. Seblatnigg

Ergänzungshefte fuer Angewandte Geophysik,
vol. 1, No. 1, 1930, pp. 110-116.

The region described in this paper has already been investigated by C. A. Heiland. Under the direction of Seblatnigg, magnetic measurements were made in May, 1930, in the region to the east of Berggiesshübel. A map showing the geological structure of the region is given. Measurements of the vertical intensity were made by means of two local variometers manufactured by Askania-Werke. Sensitiveness of the instruments was about 60 γ per graduation of the scale. It was established that the limits of error did not exceed 30 γ. The position of the stations is shown in a figure. Isodynamics of the vertical intensity were drawn by interpolation from the results obtained at single stations. Highest positive values of vertical intensity could be expected at stations below which ore has been proved with certainty, but just the contrary was observed. The highest negative values (-1500 γ) were observed at the southwestern border of the region under investigation at the place where the Muttergottes deposit has been developed.

From the course of the isodynamics and from the form of several regions of disturbance a conclusion can be drawn that the upper limits of the deposits, by which the disturbance is caused, lie at a depth not over 20 to 40 meters below the earth's surface. From the conformity of the position of the extreme negative values a conclusion can be drawn that magnetite is the real cause of these magnetic disturbances.

In conclusion the author says that the magnetite deposit of Berggiesshübel, as it seems, is the first case in which the direction of magnetization, established with certainty on a large area, does not agree with the direction of the present magnetic earth field. Although the problem can not be solved definitely based on tho results obtained these results may contribute to the question of local magnetic disturbances. The author expects to continue the investigations on a larger scale.--W. Ayvazoglou.

REPORT ON THE NIPPON SUIROBU MAGNETOMETER, JAPANESE HYDROGRAPHIC DEPARTMENT

Japanese Journal of Astronomy and Geophysics, vol. 7, No. 3, March, 1930.

I. Introduction. The Nippon Suirobu magnetometer is a portable instrument for measuring the three elements of terrestrial magnetism, designed with a view to simplicity and rapidity of operation.

II. Measurement of Magnetic Elements.

1. Declination. When the transverse axis of the Helmholtz-Gaugain coil is placed in a horizontal position and the coil is charged electrically, a small compass at its center assumes the position resulting from the superposition of the coil's field upon that of the earth.

2. Dip is measured by adjusting the axis of a rotating coil until no current is recorded on a sensitive galvanometer.

3. Horizontal intensity is measured by means of vector subtraction of the coil force from the resultant force of coil and earth.

III. The instrument consists of the following principal parts:

1. Combined theodolite and rotating coil.

2. Helmholtz-Gaugain coil and mirror magnetometer.

3. Electrical standard meter.

4. Electrical accessories:

    a. Rheostat box.

    b. Galvanometer of Broca type.

    c. Dry cells.

    d. Switches.

5. Standard coil.

IV. Standardisation of instrument.

1. The electrical constant of the standard coil was measured in the laboratory of the Central Bureau of Weights and Measures.

2. The electrical constant of the Helmholtz-Gaugain coil was determined with a potentiometer and standard resistances by Watanabe's method.

3. The temperature corrections were determined by the mechanical changes in the coils.

V. Instructions for the use of the instrument are given for observing:

1. Bearings of terrestrial marks.

2. Magnetic meridian.

3. Horizontal intensity.

4. Checking of terrestrial marks.

5. Dip.

VI. Results of observations. Trial observations were made in March, 1929, at Kakoika Magnetic Observatory. The mean differences between the values observed with the observatory magnetograph and with the present instrument were: 0.8 in declination, 0.3 in dip, and 33 gamma in horizontal intensity.

For details of formulas, instructions, tables, and photographs, the original paper should be consulted.--Irwin Roman.

AUFSUCHEN VON VERGRABENER MUNITION DURCH MAGNETISCHE UND ELEKTRISCHE MESSUNGEN

(SEARCH FOR BURIED AMMUNITION BY MEANS OF MAGNETIC AND ELECTRIC MEASUREMENTS)

By A. Ebert

Ergänzungshefte für Angewandte Geophysik, vol. 1, No. 1, 1930, pp. 9-14.

In this article Ebert describes how geophysical methods of prospecting were used for the discovery of two stores of ammunition, buried during the war, the place of which was not known. The amount, as well as the content of the stores, was unknown also.

For scientific reasons, both the magnetic and the electrical methods were used. Magnetic investigation was made by means of a vertical variometer, manufactured by Askania-Werke, with a sensitiveness of about 30 γ per scale division. Electrical measurements were made by using alternating current.

Geologically the region of investigation consisted of alluvial soil, gravel, and clay. In both cases the position of the stores was established.

Details of investigation are shown in a series of figures.--W. Ayvazoglou.

BEZIEHUNGEN ZWISCHEN ERDMAGNETISMUS UND KARBON IM OSNABRÜCKER LANDE

(RELATION BETWEEN THE EARTHMAGNETISM AND CARBON IN THE COUNTRY OF OSNABRÜCK)

By August Kaiser

Ergänzungshefte fuer Angewandte Geophysik, vol. 1, No. 1, 1930, pp. 15-22.

Kaiser tries to give an evaluation of measurements of the magnetic vertical intensity (Z) accomplished in 1928 in the region of Osnabrück. A detailed description of measurements, including tables and maps, is to appear in a short time in the "Beiträge zur physikalischen Erforschung der Erdrinde" issued by the Preussische Geologische Landesanstalt, under the title: "Magnetische Messungen in Nordwestdeutschland" (Magnetic Measurements in Northwestern Germany).

The article is divided into three parts: (1) Introduction and instrumental-physical section; (2) geologic-physical section, and (3) summary.

In the latter part the author says: "Notwithstanding the fact that the hypothesis established by H. Reich, that a negative anomaly is shown above carbon, has not been proved in Piesberg, a confirmation of this hypothesis could be discovered in general. In discussing the relation between the hill-carbon and magnetic measurement the confirmation of the above-mentioned hypothesis can be derived. Whether the Piesberg carbon agree with this hypothesis could not be established definitely. But it may be accepted that the positive effects of the crystalline subsoil cover the negative effects of the Piesberg-carbon.

The parallelism of results obtained by magnetic survey and gravity measurement is to be mentioned. The rising crystalline elevations were indicated by gravity measurement, but the exact position and extension of this elevation was established by magnetic measurement. This shows again that the magnetic method must be considered to be of good aid to geologists and mining engineers."

Two maps showing the magnetic Z-anomalies and the Bouger's gravity anomalies in the vicinity of Osnabrück are added.--W. Ayvazoglou.

THE SENSITIVITY OF THE DIP NEEDLE

By C. O. Swanson

Bulletin of the Michigan College of Mining and Technology,
New Series, vol. 4, No. 1, 1930, pp. 248-258.

The particular subject treated in this paper is the variation in the sensitivity of the dip needle with changes in the magnetic field. From a practical standpoint the investigation gives a method of adjusting the dip needle so as to make it most sensitive for the particular field under observation, and explains certain peculiarities of the instrument which have led to erroneous interpretations of magnetic data in certain cases.

Contents of the article:

1. The dip needle and its operation. A brief description of the common Gurley dip needle is given.
2. Calculation of the dip reading. Graphical representations of the calculation.
3. Application of the principles. Shown by an example.
4. The effect of abnormally counterweighting the needle. A series of abnormalities described make an instrument unfit for use.
5. Conclusion. Magnetic information obtained with the dip needle has proved very useful as a guide in working out buried structures.--W. Ayvazoglou.

DISTRIBUTION DES ÉLÉMENTS DE MAGNETISME TERRESTRE DANS LE ROYAUME DES SERBES, CROATES ET SLOVÈNES

(DISTRIBUTION OF THE ELEMENTS OF THE TERRESTRIAL MAGNETISM IN THE KINGDOM OF THE SERBS, CROATS AND SLOVENES)

By J. Mokrović

Travaux de l'institut de physique de globe de Zagreb (Yugoslavia),
1928, pp. 1-32.

The author gives the results of all measurements of magnetic elements accomplished on the territory of the present Yugoslavia from 1806 to 1918 (Marieni, K. Kreil, G. Schenzl, J. Schellander, E. Gelcić, H. Hartl, F. Laschober, V. Kesslitz, S. Schluet, J. Liznar, Kurlander, R. Eötvös, D. Pekar, L. Steiner, E. Tekete, A. Kugler, A. Gavazzi, A. Nippoldt, Carnegie Institution, A. Schedler).

Based on these data the author calculates, according to a special method, the values of D, H, and I for the epoch of 1927.5 for all the 218 stations of observation, which, of course, are distributed over the whole territory of Yugoslavia very irregularly, and draws maps of isogons, isoclines, and horizontal isodynamics. Owing to the fact that there are no new detailed magnetic measurements, these maps give a fairly good orientation in the distribution of magnetic elements.

Considerable local anomalies in the distribution of the magnetic elements which can be attributed to the geological structure of the territory (regions of crystalline slates and eruptive rocks) can be roughly determined.— V. Gorsky.

HORIZONTAL COMPONENT OF THE ANOMALOUS MAGNETIC FIELD IN KHORVATIA AND SLAVONIA (IN SERBIAN)

By J. Mokrović

Bulletin de l'institut de Zagreb (Yugoslavia),
vol. III, 1929, pp. 98-105.

Based on the measurements made by A. Kugler in 1915-1916, reduced to 1927.5 the author works out the declination and horizontal tension of the magnetic field for 80 stations of observations in Khorvatia and Slavonia in order to calculate the anomaly of the horizontal magnetic field.

The author gives maps showing terrestrial isogons and horizontal isodynamics with isometrics of declination and horizontal tension, as well as a map showing the vectors of the horizontal component of the anomalous magnetic field. The distribution of anomalies is in absolute and interesting relation with the geological structure of the region.—V. Gorsky.

APPLICATION OF MAGNETIC METHOD OF PROSPECTION (IN SERBIAN)

By D. V. Frost and P. V. Gravirovsky

Rudarski i Topionički Vesnik (Bulletin of Mining and Metallurgical Industry),
Belgrade, vol. 2, No. 6, 1930, pp. 269-273.

Two examples of magnetic survey carried out by Gravirovsky (Bureau des Récherches Minières, Mulhouse, France) with Ad. Schmidt's vertical variometer in southern France are described.

In one case the extension of an ophite massif (positive anomaly of vertical intensity) below the alluvial cover was proved over a larger territory than could be expected from the outcrops of the ophite; this resulted in elimination of borings for salt (trias) and other unnecessary work.

The place of boring was established at the maximum negative anomaly of vertical intensity.

In the second case the continuation of a fault in the oil-bearing oligocene has been proved. Detailed data and the places of the survey are not given.--V. Gorsky.

3. SEISMIC METHODS

BUYING EARTHQUAKES IN SEARCH FOR OIL

By C. Van A. Pittman

The Oil and Gas Journal, vol. 29, No. 10, 1930, p. 129.

Seismic work necessitates the use of dynamite and often enough of it to drive a seismic impulse a mile in depth to a point 10 miles distant on the surface. Charges vary from 50 to 2,000 pounds, and sufficient noise must be produced to be detectable at the seismograph station so that its distance from the shot point may be determined after proper corrections have been made for the velocity of sound in air. A great deal was accomplished in developing portable field seismographs (Fessenden, Karcher, Mintrop, Petty, McCollum and others) until they have reached their present stage of all-around general utility in geophysical exploration work.

Outstanding success has been attained in geophysical prospecting in the Texas and Louisiana Gulf Coast fields and in southern Persia in the discovery of salt domes. The same success will doubtless result from works in all the other parts of the world in which reconnaissance surveys with the seismograph have already been made. Thus, the sale of earthquakes is rapidly becoming an international business.

Graphs referring to Texas and the Gulf coast, given by the author, show the growth of increased efficiency on the part of seismologists and their instruments and of the potential business that this new branch of applied science is developing for dynamite manufacturers.--W. Ayvazoglou.

SEISMIC SURVEYS

Editorial note

Canadian Mining Journal, vol. 51, No. 24, 1930, p. 575.

This note is written in connection with the visit of Dr. R. Ambronn of Canada. Dr. Ambronn reviewed the seismic field work carried out last winter in southwestern Ontario near Tilbury and in the Turner Valley, Alberta.

A brief explanation of the method, as used by Ambronn, was discussed at a conference of leading geologists and mathematicians at Ottawa.

A table shows the velocities for different materials:

Rocks	Average velocities, meters per second
Sands	600
Soft clays	1,000
Clayey shales	2,000
Sandstones	2,200
Marls	2,500
Slates	3,000
Limestones	5,000

A simple illustration to show how the theory works in practice is given.

The conclusion is drawn that by the seismic method it is possible to determine the petrological differences in the subsurface, together with the tectonic structure such as strike, dip, faults, synclines and anticlines,—and also the dip of the crests of anticlines and their deviations.—W. Ayvazoglou.

4. ELECTRICAL METHODS

GEOELECTRICAL EXPLORATION METHODS USED IN OIL FIELDS

By Helmer Hedstrom

The Oil Weekly, vol. 58, No. 6, July 25, 1930, pp. 34-37.

The article is essentially a presentation of the Sundberg electromagnetic method of prospecting.

An elementary explanation of the meaning of conductivity and resistance and the factors that affect the conductivity of rocks is followed by an example of the correlation of strata by measurement of the electrical resistance in the drill-hole walls but no information is given as to how these measurements were made. A brief description of two unsuccessful electrical methods and the causes of failure includes a curious confusion of ideas of electric current versus electric waves.

The Sundberg method consists in measuring the characteristics of the electromagnetic field produced by an alternating current in a wire and modified by the presence of conducting layers in the ground. An insulated copper cable several miles long is laid in a straight line on the ground, a return wire is brought round at a considerable distance from the cable, and observations are made at different distances from the cable on equally spaced transverse lines. The detecting instruments are a search coil, a "compensator," and an amplifier, but no details are given of their use or the resulting measurements, merely very general statements as to the computation of depth to the "electrical key beds" and representation on a contour map.—Kenneth Hartley.

SOME EXPERIMENTS WITH EARTH CURRENTS

By Hiasi Noto

Japanese Journal of Astronomy and Geophysics, vol. 7, No. 3, March 10, 1930.

I. Introduction. The present investigation involves the stray currents in the subterranean section of a large city and especially the effects of electric railways. Only the general features are considered.

II. Preliminary experiments were made to study the magnitudes of some of the effects which could not be eliminated. The instruments used were a Dolezalek quadrant electrometer and a Siemens microammeter with a Wheatstone bridge for the current shunt.

1. The effect of the electrode metal was determined by using a sheet of copper for one electrode and various metals for the other electrode. The electrodes were buried 20 centimeters apart in a wooden box filled with loam. The potential difference was measured with the soil in natural condition, with distilled water around the electrodes, and with saturated salt water. The maximum observed difference was 67 millivolts.

2. To study the effect of the soil, one electrode of copper was buried in a mixture of loam and a small amount of sand. The other was buried in various media, including a similar mixture, river sand thoroughly washed and cleaned, loam, gravel about 3 to 5 millimeters in diameter, black humic soil under grass, and unwashed river sand. The maximum difference in potential was 2.8 millivolts for the humic soil, with the others was very much smaller.

3. The effect of acids and bases was determined with copper electrodes in various soils, adding NH_4OH, NaOH, KOH, HCl, or H_2SO_4. The maximum effects were observed with NH_4OH, being about 80 millivolts.

III. To study the distribution of natural stray currents, two lead balls about 4 centimeters in diameter were buried about 4 meters apart at various depths. The resistance was found to vary from about 550 ohms at a depth of 3 meters to about 1,200 ohms at 0.5 meters. The stray current varies widely in different districts. Near the summit of Mt. Tukuba the current was large compared with other districts free of artificial effects. Between a lightning conductor on the roof of the observatory at the summit and an electrode about 100 meters below that place, a current of about 1.07 milliamperes was found on a clear day. In a mountainous region, one of 0.05 milliamperes was found for that distance. In general, except for isolated peaks, stray currents are believed to be due to artificial causes.

IV. Stray currents in a city. As a result of corrosion of a lead pipe buried in a concrete wall, the stray current was measured between the pipe and a copper earth plate, using a self-recording ammeter. The conclusions were mainly as follows:

1. Electric disturbances in the earth seem to originate from distant as well as near points, being detectable when all neighborhood sources are absent.

2. Stopping the water supply at the main station does not seem to affect the stray current.

3. A heavy rainfall causes a sudden increase in strength, due probably to decrease in resistance.

4. The amplitude of oscillation gradually changes over a long time with no apparent cause.

5. Digging the earth near the electrode affects the current, and it is inferred that the effective layer of the earth is not over 6 meters.

6. A magnetic storm increased the current abnormally.

7. The current may be caused by a temperature difference between the electrodes, the passage of tram cars, or the difference in the metals of the two electrodes.

V. Stray currents from electric railways were studied from 2 to 4 a.m. when all electric cars within 100 kilometers were stopped, except for those under study.

1. Part I. June 20-24, 1929. The line from Higasikanagawa to Hatiozi was loaded and all other rails were insulated. The loading was either by a train or a special device. The train consisted of five electric locomotives with a maximum current of 1,000 amperes. The special device discharged about 1,000 amperes for 30 seconds. The total current was measured with a self-recording ammeter. The return circuit was either a feeder or a rail line. Four copper plates were connected by insulated wires, the plates being surrounded with carbon pieces to insure good contact. The electrodes were buried about a meter deep. Electrode I was about 60 centimeters below the water line. Electrode II was about 40 centimeters below the water line, about 200 meters away from I perpendicularly to the rail. Electrode III was about 40 centimeters below the water line. Electrode IV was about 30 meters above the water line, about 160 meters away from III in a line parallel to the rail. A natural current of about 50 millivolts per 150 meters was cancelled by an impressed electromotive force. The general results are:

   a. An opposite current flowed for some time after the circuit was opened, but only perpendicularly to the rail, due possibly to polarization.

   b. The zero line is deflected as soon as the pantograph of the electric locomotive makes contact with the transmission line, when the switch is turned off, due probably to leakage.

c. The perpendicular current is larger than the parallel, the field being nearly perpendicular to the rail when the car is near.

A newspaper train from Tokyo to Yokosuka was also studied. The locomotive weighed 92 tons, had a starting current of 150 amperes and a maximum current of 250 amperes. There were also two cars. Each time the train started, the record was affected, the deflection increasing as the train approached.

2. Part II. August 22-27, 1929. In this part of the investigation, the copper plates were replaced by special electrodes consisting of copper wire and a tube within a glass tube containing $CuSO_4$. The total resistance between the electrodes was about 2,600 ohms as compared with 40 to 60 ohms in the previous experiments. Two additional conclusions were made:

a. Currents in the ratios 10:7:5:2:1 caused deflections in the ratios 24:19:15:5:1. Thus the leakage is not proportional to the current discharged.

b. The first discharge of a group caused the largest deflection, indicating an electrochemical action tending to oppose the passage of the current flow.

c. In order to study natural currents, all artificial causes within at least 25 kilometers must be stopped, since the newspaper train showed noticeable effects at that distance.
—Irwin Roman.

THE EARTH-RESISTIVITY METHOD OF ELECTRICAL PROSPECTING

By E. Lancaster-Jones

The Mining Magazine, vol. 42, No. 6, 1930, pp. 352-355;
and vol. 43, No. 1, 1930, pp. 19-29.

The author describes the earth-resistivity method of electrical prospecting carried out with the Megger earth-tester. The article is divided into the following headings:

1. Field procedure.
2. Apparatus (a picture of the Megger earth-tester is given).
3. Consideration of results.
4. Application to prospecting for ore.
5. Mathematical theory of potential distribution in earth resistivity circuits (diagrams of characteristic curves are given.).
6. Test survey in Cumberland (two maps of the region surveyed, known as the Red Hill area, are given).

7. The Megger earth-tester (a diagrammatic representation of the system of components and connections) is shown in a figure.

8. Details of the test survey in Cumberland (sections across the area on the four marked lines are illustrated).

9. Conclusion.

The author says: "The test has shown that the more elaborate theory of earth-resistivity previously described is necessary to represent correctly the phenomena which occur in practical exploration. Even with this expansion in the theory, the observed data require careful and critical analysis if correct interpretations are to be obtained. Whilst it will generally be desirable to make a series of measurements at several electrode spacing intervals at each of a series of selected critical stations, a very valuable preliminary reconnaissance over the whole area can be obtained using only a single spacing interval, carefully chosen with reference to the most probable depth of the surface of which it is sought to map the features. For mapping subdrift or similar features, the method would appear to be very economical and promising, but further tests of typical regions are desirable to establish the correct principles or procedure and interpretation."

The total time spent in the field during the survey described was about one month and the personnel varied from three to four.--W. Ayvazoglou.

ELEKTROMAGNETISCHE AUSGLEICHSVORGÄNGE IN GESCHICHTETEM ERDREICH

(ELECTROMAGNETIC EQUALIZATION PROCESSES IN THE STRATIFIED SOIL)

By Franz Ollendorff

Archiv fuer Elektrotechnik, vol. 23, No. 3, 1930, pp. 261-278.

Contents of the article:

1. Introduction; purpose of the work.
2. Equations calculated for a steady field.
3. The electric field in case of a current impulse.
4. Series connections on the surface of the earth.
5. The origin of a short circuit current.
6. Numerical example.

The summary of the article, as given by Ollendorff, reads as follows:

The electromagnetic process of equalization in laminated conductors is examined; in particular the return-line arrangement of panels in homogeneous soil with higher surface conductivity is represented by it.

The steady field is specified by an integral representation from which the field of a current impulse appearing suddenly can be derived by another integration. By interchanging the succession of the integration, elementary and complete expressions for the arrangement of panels can be derived. Near the line (Nahzone) fields of highest voltage appear immediately after the closing of the circuit, while for more distant places a certain time is required until the disturbance produces the maximum effect. From this a microscopic velocity of propagation of the spreading process can be defined which is proved to be the constant of the electrical plate-data.

From the field of a current impulse the processes of equalization can be calculated by elementary integrations; they correspond to a direct current increasing exponentially, or to an alternating current appearing suddenly. It is shown that in the first case the field of connection decreases slowly, after the passing of a maximum, in an inverse ratio of time.

The maximum value itself is estimated; it is considerably smaller than the excess voltage appearing during a sudden rise of the current. The mutual inductance which is decisive for this is limited, under average conditions, by the value of the order of from $0.5 \cdot 10^{-3}$ m. Henry|km.; it depends logarithmically only to an extremely small degree on the distance of the lines influencing one another. For the alternating current method of connection there results a similar estimation, that the stationary voltage is just of the same value as the maximum connection voltage, so that an excess voltage which is twice as much as the stationary voltage appears.

If the voltage impulse is put directly on the closed circuit a short circuit current is developed. For the progress of this short circuit current a Volterra's integral equation is derived which can be solved by the approximation proceeding. It was found that the current increases in the beginning very quickly, about linearly, later more slowly, but never becomes stationary under the assumptions mentioned above.

The impossibility of definition of a stationary condition forms a characteristic feature of the process of connections discussed in this article.

The conditions of the process of connections inside of the soil is examined by means of several numerical examples. The intention is to extend the method used here for the disclosure of the connecting circuit in a semi-space limited by planes.--Author's abstract translated by W. Ayvazoglou.

SULLA MISURA DI CAMPI ELETTROMAGNETICI DI UNA CORRENTE ALTERNATA IMPRESSA AL SUOLO

(ON THE MEASUREMENT OF ELECTROMAGNETIC FIELDS PRODUCED ON THE GROUND BY ALTERNATING CURRENT)

By Arnaldo Belluigi

Ergänzungshefte fuer Angewandte Geophysik, vol. 1, No. 1, 1930, pp. 4-8.

A new method by means of which the electromagnetic field produced by an alternating current can be measured in making geoelectric investigations is discussed.

The author draws attention to the defects of different efforts made so far for the solution of this question.--Author's abstract translated by W. Ayvazoglou.

ELECTRICAL METHODS OF PROSPECTING (IN SERBIAN)

By S. Verbič

Rudarski i Topionički Vesnik (Bulletin of Mining and Metallurgical Industry),
Belgrade, vol. 2, No. 5, 1930, pp. 223-226.

The author gives a brief systematic outline and classification of electrical methods of prospection, as well as a comparison of the methods.--V. Gorsky.

A CRITICAL REVIEW OF DIFFERENT ELECTRICAL METHODS OF PROSPECTING AND A LABORATORY STUDY OF ONE OF THESE METHODS (IN SLOVENIAN)

By V. Gorsky

Manuscript published by the Institute of the Surveying of Mines at the University
at Ljubljana in Yugoslavia, 1926, pp. 1-150.

The author compares the different methods of electrical prospecting and gives maps and numerical data on the results of the laboratory studies of the equipotential method. The measurements were made on different iron, glass, and wooden models buried in different positions in a box filled with sand. The application of different kinds of current (alternating, direct, different intensity), different electrodes and apparatus was studied. Methods of measurements were tried out in order to establish the most suitable one for studying the deformation of the equipotential lines with relation to the form and position of the body. A study was made of the most simple method of direct measurement of the potential difference by means of a voltmeter connected between one primary electrode and one single point electrode. Difficulties, advantages, and defects of the method and possibilities of its improvement are discussed.--Author's abstract.

COMMUNICATION SUR LES RÉCHERCHES ÉLÉCTRIQUES DE MINERAIS ET D'HUILES

(COMMUNICATION ON ELECTRICAL METHODS OF SEARCHING FOR MINERALS AND OILS)

By K. Sundberg and H. Hedstrom

II-e Congrès International de Forage, Paris, 16-23 Sept., 1929.
Special print issued in Saint-Etienne, 1929, pp. 1-19.

The authors describe the importance, nature, and practical application of electrical methods of prospecting (especially Swedish) for ores and oil. The following diagrams are given:

1. Vector diagram showing horizontal component of electromagnetic field at the surface 100 meters from the primary cable. It is evident from this diagram that if only one conducting layer is present at a certain depth under the surface, then both the depth and the electric properties of this layer can be determined with the Sundberg electromagnetic method by measuring the horizontal component of the electromagnetic field at one single point (there are similar diagrams for the vertical component).

2. Relation between resistance factor P and per cent of volume V of water in rocks, and

3. Relation between chlorine content of waters and their specific electrical resistance.--V. Gorsky.

SUR LA DÉTERMINATION ÉLECTROMAGNÉTIQUE DU PENDAGE DES COUCHES SEDIMENTAIRES

(ON THE ELECTROMAGNETIC DETERMINATION OF THE HANG OF SEDIMENTARY DEPOSITS)

By C. and M. Schlumberger

L'écho des mines et de la metallurgie, vol. 58, No. 3032, 1930, pp. 473-474.

The anisotropy of sedimentary formations makes it possible to carry out electrical studies of the hang[1] of underlying deposits; this constitutes the practical problem in geophysical research work in case a direct geological observation is impossible.

A brief description of theoretical proceedings and practical confirmation of these studies is given.--W. Ayvazoglou.

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[1] - Hang - the hade of a fault.

6. GEOTHERMAL METHODS

THE EFFECT OF TEMPERATURE DISTRIBUTION ON THE DEFORMATION OF A SEMI-INFINITE ELASTIC BODY

By G. Nishimura

Bulletin of the Earthquake Research Institute, Tokyo Imperial University,
vol. 8, part 2, 1930, pp. 91-143.

Nishimura studies the problem of the effect of the temperature distribution and variation in the neighborhood of the surface upon the form of the earth crust.

The mathematical part of the article consists of three parts: In the first the author has obtained the general equations of equilibrium of the elastic solid when the variations of temperature occur; in the second part the two-dimensional problem is discussed; in the third part the three-dimensional problem is discussed; in these last two parts some examples have been solved by using Fourier's double integral formula.

In his résumé the author says;

Some results are obtained which may be interesting on the geophysical problems and of which the principal facts are enumerated as follows:

1. The magnitude of the displacement at a given point in the solid is proportional to the temperature at that point.

2. The surface distribution of displacements is, of course, affected by the temperature distribution of the surface, and especially by the distribution in the interior of the body; i.e., the displacement or the tilt of the surface of the solid is inversely proportional to $(1+\beta')$ where β' is a constant which specifies the temperature distribution in the interior of the solid.

3. The surface displacement becomes maximum when the temperature distribution is constant through the whole depth of the interior of the solid.

4. Even when the surface temperature is discontinuous, the surface, as well as internal deformation of the body is continuous and in this case the portion of no temperature change is also deformed.

5. Even if the temperature distribution of the surface of the solid is of a decided nature, the surface deformation of the solid has a moderate nature.

6. When the temperature distribution of the surface of the solid is assigned to be of a certain decided nature, the change of the surface displacement due to the small variation of the temperature distribution in the interior of the solid is very marked."--W. Ayvazoglou.

GEOELECTRIC PROSPECTING FOR ORE

By Arnaldo Zabelli

The Mining Journal, vol. 170, No. 4955, 1930, pp. 641-642.

Under this title the author discusses briefly the subject of natural geoelectric current for the search of sulphur minerals and oscillatory currents artificially produced in the ground for the search of insulating minerals (for instance sulphur and petrol).—Author's abstract.

SUR LES MESURES DE TEMPÉRATURE DANS LES SONDAGES

(THE MEASUREMENT OF TEMPERATURE IN BOREHOLES)

Editorial note

L'écho des mines et de la Métallurgie, vol. 58, No. 3029, 1930, pp. 384-385.

The use of a special thermometer, the tube of which is cut obliquely at its upper end at an angle of 45° to the axis of the tube, is recommended and the carrying out of observations of the temperature in boreholes by means of these thermometers is described (See Geophys. Abs. No. 14, p. 16, Friedel and Maikowsky, "Measurement of temperature in boreholes").--W. Ayvazoglou.

7. UNCLASSIFIED METHODS

THE PRINCIPLES OF GEOPHYSICAL SURVEYING

By Henry Briggs

Colliery Engineering, vol. 7, Nos. 75 and 76, pp. 178-184, 187, 202-206.

Before starting with the examination of geophysical methods of prospecting Briggs makes some remarks on the conditions of geophysical prospecting in general, based on the fact that the attitude of scepticism established in this connection some 10 or 12 years ago is no longer encountered and the physicist is permanently established in the position he has captured in the mining world.

Application to Coal Mining. Although the methods have so far been applied to oil and metalliferous practice only, the author is of the opinion that geophysical prospecting can be of practical consequence in coal mining also.

Trustworthiness of results. All geophysical processes depend on the measurement of variations of some kind or other. They give merely negative results unless differences exist in the forces or effects with which they are concerned. The more pronounced the differences the clearer the indications they provide and the more certain the conclusions drawn from them. Geophysical processes gain in trustworthiness by being applied in combination.

Common-sense basis of geophysical surveying. The first thing is that all the methods rest upon accepted and proved tenets of physical science. In the second place the geophysical surveyor must not allow himself to be carried away by an undue optimism. He has to admit many failures just as he can point to many signal successes. With the growth of experience the skilled observer is becoming better able to assess the chances of success of any proposition that may be put to him.

Geophysics the handmaid of geology. Geological guidance is a most important factor, and the more completely the general geological structure of a district is known the simpler is the geophysicist's task and the more reliable his results.

The origin of the methods and the literature on geophysical surveying are mentioned briefly. After these introductory remarks the author goes over to the discussion of the different methods:

Magnetic methods, their principles, instruments used and application, shown on several examples, are examined in the first part of the article (vol. 7, No. 75). The second part (vol. 7, No. 76) deals with electrical methods of prospecting. A series of figures, diagrams, and graphs accompany both parts. The article is to be continued.--W. Ayvazoglou.

THE APPLICATION OF GEOPHYSICS TO MINING, WITH SPECIAL REFERENCE TO THE LOCATION OF FAULTS

By Capt. H. Shaw

The Institution of Mining Engineers, London, Transactions,
vol. 79, part 2, 1930, pp. 130-145.

The four general methods are considered and the fundamental principles given in each case, after which their application to mining, particularly to the location of faults, is discussed.

A table of magnetic susceptibilities is included, and Slichter's figure is given of the limiting value of the susceptibility, below which no recognisable effect can be obtained. The location of faults by electrical methods is considered briefly, after which the gravitational method is outlined and its practical applications, such as the location of faults, structural features, dykes, ore masses, buried river beds, etc., referred to.

The seismic method is explained and the problems of determining the depth of cover and of locating simple faults are considered.

The time-distance curves obtained along a profile across a known fault at Hodbarrow are reproduced and compared with the curves to be expected from theoretical considerations.

The paper concludes with a table in which are set out the various methods, their applications, and their limitations.--Author's abstract.

THE IMPORTANCE OF APPLIED GEOPHYSICS FOR THE MINING INDUSTRY (IN SLOVENIAN)

By V. Gorsky.

Manuscript published by the Institute of the Surveying of Mines at the University of Ljubljana in Yugoslavia, 1926, pp. 1-221.

In this work the author gives an outline of the conditions, successes and estimations of the present and future importance of geophysical methods of prospecting in the mining industry, based on the literature published up to 1925, inclusive.--Author's abstract.

GEOPHYSICAL METHODS OF PROSPECTING AND THEIR IMPORTANCE TO YUGOSLAVIA (IN SERBIAN)

By D. V. Frost

Rudarski i Topionički Vesnik (Bulletin of Mining and Metallurgical Industry), Belgrade, vol. 2, No. 2, 1930, pp. 57-59.

A brief description is given of the principles of geophysical methods of prospecting and of the importance of their application in Yugoslavia.--V. Gorsky.

MEASURING THE DEPTH OF DEEP WELLS

By C. E. Van Orstrand

Reprint from the Oil and Gas Journal, issue of March 8, 1928, 2 pp.

In this article Van Orstrand examines the various obstacles that prevent the precise measurement of the depth of a deep well, such as:

1. Thermal expansion.
2. Deviation from the vertical.
3. Sounding bottom.
4. Sliding friction.

The inaccuracies involved by these obstacles are more or less common to all methods of deep well measurement which are dependent on lowering a material object to the bottom of the well. In the following the author discusses the errors inherent in the individual methods themselves:

1. Measurements on casing and drill pipe.
2. Stringing over the derrick.

In discussing the possibility of devising a machine that will accurately record the depth of a deep well the author says that the numerous attempts made on this subject have remained so far without success. Two views of a flexible type of machine that the author uses for measuring the depths to which thermometers are lowered into deep wells while making temperature tests are given; the operation of the machines is described.

A proposed arrangement of measuring wheels and guiding pulleys which has been designed to meet three fundamental and necessary requirements in the construction of a measuring machine--namely, stability, flexibility, and an equalized distribution of load on the cable--is shown in a figure.

In conclusion the author expresses the opinion that even assuming that a perfect measuring machine can be constructed, the fact remains that the true depth of a well can not be determined--the point determined by the "pick up" can not be accurately located and the measurement of the depth is dependent on the drag of the line and bailer on the casing as the cable is removed from the well.--W. Ayvazoglou.

A NEW GEOPHONE

By C. A. Heiland

The American Institute of Mining and Metallurgical Engineers,
Technical Publication No. 330, 1930, 10 pp.

The new geophone described in this paper was developed by the author and Charles H. Hull. After a brief description of the principles of the geophone, Heiland comments upon the work done on it during and after the war by the Bureau of Mines.

Publications issued by the Bureau of Mines concerning the geophone in which the possibility of using the geophone in mining is discussed are mentioned.

The author divides his article into the following main parts:

1. Applications of the geophone.
2. Sensitivity of the geophone.
3. Quantitative tests with geophone.
4. The new geophone.

In the last part Heiland gives a description of his method. Two figure showing (1) the new (push-pull) geophone arranged for visual observation and (2) geophones arranged for use, are added.--W. Ayvazoglou.

8. GEOLOGY

GABBRO-MASSIF NEAR JABLANICA (IN SERBIAN)

By L. Marić

Bulletin de l'institut géologique de Zagreb (Yugoslavia),
vol. 2, 1927 28, pp. 1-65.

The author gives a detailed mineralogic-petrographical description of the gabbro-massif near Jablanica on the border of Bosnia and Herzegovina.

The author proves that there is no contact zone at the border of the massif by which it may be proved that the gabbro intrusion is younger than the Trias, as is asserted by Katzer and Kossmat. Investigations carried out by the author confirm Kispatic's opinion that the origin of gabbro, as well as all the ophiolite rocks of the "serpentine zone" of Bosnia, must be assigned to older times than the sedimentary rocks in which they are intruded. The position of the gabbro-massif is defined also by strong geodynamic processes occurring in this region.

The investigations may be of interest also from the viewpoint of applied geophysics. The gabbro described is rich in magnetic and must cause magnetic anomaly.

By means of magnetic measurements the existence or absence of a mutual relation at a certain depth of single gabbro-massives scattered in Bosnia could be determined, and the study of tectonics and stratigraphic position of the serpentine zone in Bosnia could be made more clear.--V. Gorsky.

BAUXITES IN HERZEGOVINA, ESPECIALLY IN THE REGION OF MOSTAR (IN SERBIAN)

By T. Jaksić

Bulletin de l'Institut Géologique de Zagreb (Yugoslavia),
vol. 2, 1927 28, pp. 82-120.

The author describes the bauxite deposits in Herzegovina. Owing to the very favorable situation and forms of these deposits they may serve with great success for detailed magnetic measurements in order to establish the possibilities for magnetometric prospection of bauxites in general.--V. Gorsky.

9. NEW BOOKS

Handbuch der Geophysik (Handbook of Geophysics). Seismometer, Auswertung der Diagramme (Seismometer, Evaluation of Diagrams), by H. P. Berlage; Geologie der Erdbeben (Geology of Earthquakes), by A. Sieberg. Vol. 4, part 2, 1930, pp. 299-686, 255 figs. Gebrüder Bornträger, Berlin. Price, 30 M.

Hosmer, George L. Geodesy, Including Astronomical Observations, Gravity Measurements, and Method of Least Squares. Second edition. New York, John Wiley and Sons, Inc. London, Chapman and Hall, Ltd. Price, 22 s. 6 d. net.

Boutry, G. A. Les Méthodes Géophysiques de Prospection Appliquées a la Réchérche du Pétrole (Geophysical Methods of Prospecting as Applied to the Search for Oil). Paper covers, 172 pp. illustrated. Price 20 francs. Paris, La Révue Pétrolifière. The book concludes with a bibliography of publications on the subject of geophysics.

Maurin, Ch. Le Méthodes Géophysiques pour l'Étude des Couches Superficielles du Sol (Geophysical Methods for Studying Superficial Deposits). Paper covers, 29 pp. illustrated. Price, 10 francs. Paris, La Révue Pétrolifière, A useful list of references is added. This is a reprint of two articles which appeared in Nos. 322 and 323, 1929, of La Révue Pétrolifière.

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